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CORNING GLASS WORKS

ELECTRO-OPTICS LABORATORY

RALEIGH, NORTH CAROLINA

IMPROVED SCREEN FOR REAR PROJECTION VIEWERS

Technical Report No.: 2

Date: 9-20-65

Period Covered: 8-15-65
to
9-15-65

[redacted]

[redacted] 25X1
25X1

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I. Accomplishments

1. Literature Search

a. Open Literature

The remaining literature was ordered during this period and about 95 percent of all the literature requested during the search has been received. A total of about 30 articles have been obtained which are directly concerned with projection screens. The remaining 160 cover the many other aspects of the program such as instrumentation, resolution, scattering, and particle size determination from scattering parameters and etc.

b. Patent Literature

The results of the patent search directed by [redacted] has been received along with one copy each of 36 U. S. patents. In addition he included references to 5 British, and 1 each Danish and Australian patents which have been ordered. Of the patents received to date there are 42 U. S., 7 British, and 1 French. 25X1

c. Most of the literature on projection screens thus far read concerns itself with the basic relations between screen scattering properties, illumination, and viewing geometry. There is a lack of important literature on topics covering screen resolution and its measurement, comparisons between volume and surface scattering, and designing optimum screens by specifying their scattering properties and computing the required physical parameters.

In addition little information is available on more advanced concepts such as applications of fiber optics and light amplifying techniques to projection screens.

The patent literature is concerned primarily with the making of screens and particularly their surfaces. Many describe techniques to imbed particles in or on a substrate or make a particular design on the surface by cutting, grooving, or pressing with various shapes.

2. Preliminary Theoretical Investigation: Screen Resolution

This study was undertaken to determine if a reformulation of the theory of resolution and/or its measurement is required because of the unique differences between image forming devices, for which it was developed, and light scattering display materials, to which it is to be applied. If modification of the present theory is required a significant portion of time during the theoretical phase of the program may be needed to formulate a meaningful quantative measure of projection screen resolution. Also a special effort to obtain pertinent literature should be made during the literature search and as much time as possible given to clearly defining the problem and searching for possible solutions.

The study will include a general introduction to the problem along with an illustration of its uniqueness. This will be followed by a mathematical development of the measure of resolution, its significance, and relation to measurable quantities. A review of conventional techniques to measure resolution and their applicability to projection screens will be included. The results of the study will be summarized and discussed in relation to its objectives.

3. Progress on a New Optical Fiber Screen Material

a. Our Danville, Virginia, facility delivered the first sample of a hollow highly reflective fiber material. The fiber is Vicor brand glass

impregnated with an oxide of Molybdenum. This gives a glass which is opaque and black in appearance and highly reflective on the surface. The tubes are about 119 μ in outside diameter with about a 56 μ bore.

b. A new type of fiber material is being fabricated by Corning in their Television Products, Market Development Department at Corning, New York. This work is being done in conjunction with the Army Engineering Research and Development Laboratory, Fort Bel Voir, Virginia. A sample of this material assembled into a matrix measuring 22 mm x 23 mm and 4 mm thick has been obtained on loan. The fibers have hollow square cores rather than conventional solid round ones.

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Since these fibers and fiber plates are being used as channel amplifiers their optical properties have neither been considered nor measured. We expect having some of these made for us using glasses with suitable optical properties rather than the present material with large secondary emission coefficient. We will then measure the optical characteristics of these fibers.

c. Another group in Corning's Television Products, Market Development Department is making progress on conventional, cladded, solid core, fiber optics. They have been able to build fiber plates which maintain high resolution over a relatively large angular field. We will obtain samples of these and evaluate them as to their applicability to rear projection screens.

4. Instrumentation

A collection of literature on commercial goniophotometers has been made. All of the 20 companies contacted have replied. Unfortunately, only 4 have instruments which in any way meet our requirements. These instruments range in price from $2,760 to $15,000.

II. Next Period Objectives

1. Literature Search

a. Open Literature

The interim report covering the first phase of this program, i.e., the literature search, will be outlined and its writing will commence. A major portion of this should be finished by the end of the period and the interim report ready in the three months alloted for this phase of the program.

b. Patent Literature

The patent literature will be digested and assembled into a section of the interim report on patents. This portion should also be completed by the end of the period.

2. Familiarization with Corning Manufacturing Facilities

A trip to Corning, New York, to become more familiar with their manufacturing facilities is scheduled in this period. A brief trip report of the specific facilities pertinent to this program will be included in the report.

3. Progress on a New Optical Fiber Screen Material

a. Techniques will be considered for determining the optical transfer characteristics of the fibers and matrix to be delivered.

Several people who are familiar with the Vicor brand glasses will be consulted during the forthcoming trip to Corning, New York. Of interest, are the following:

1. Over what range of concentrations can the amount of Molybdenum oxide in the glass be varied and what is the corresponding charge in its optical properties, i.e., refractive index, reflectivity, opacity?

2. What substances other than Molybdenum can be used to impregnate the glass?

b. Samples of individual square fibers will be requested from our Corning, New York, facility. In addition, we will consult with the group making these fibers and start a program to obtain samples of both fibers and a moderately sized fiber optics plate.

c. We will also investigate what type of materials can be used to replace those presently used for the square hollow channel amplifier fibers.

Our Danville, Virginia, facility will now try to put a highly reflective coating on the outside of hollow fibers made from clear Vicor brand glass. These are expected to have lower losses than a solid fiber and by reducing the wall thickness its transmission should approach that of a fiber which has a highly reflective inside coating.